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Users' Manual for CFD Industrial Codes
OS/2 2.0 Version

Bharat B. Aggarwal
Mechanical Technology, Inc., Latham, New York

October 2005

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The source and executable files for the CFD Seal Analysis Industrial Codes, of which this is a part, were released as LEW–16582 in 1998. This report was originally published by Mechanical Technology, Inc., in October 1993.

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Users' Manual for CFD Industrial Codes OS/22.0 Version

Bharat B. Aggarwal

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1.0 Introduction

This manual for the OS/2 versions of the CFD Seal Analysis Industrial Codes describes the installation procedure (Section 2), the system executive (Section 3), and the procedures for using the graphical user interface to run the industrial codes (Section 4). Please consult the technical manuals for the individual codes for technical details.

The following components are included in the package:

- ❑ Executive Shell (EXEC)
- ❑ Gas Lubricated Spiral Groove Cylindrical and Face Seals (SPIRALG)
- ❑ Incompressible Spiral Groove Cylindrical and Face Seals (SPIRALI)
- ❑ Spiral Groove Face Seal Optimization Program (FACE)
- ❑ Gas Lubricated Cylindrical Seals (GCYL)
- ❑ Gas Lubricated Face Seals (GFACE)
- ❑ Incompressible Cylindrical Seals (ICYL)
- ❑ Incompressible Face Seals (IFACE)
- ❑ Labyrinth Seals (KTK)
- ❑ Seal Dynamics Analysis Code for Cylindrical and Face Seals (SEALDY)
- ❑ User Interface for Scientific Code (SCISEAL)
- ❑ Fluid Properties Calculation Program (FLUID)
- ❑ Plotting Program used by GCYL, GFACE, and ICYL (PLOT4DPM)
- ❑ Plotting Program used by Dynamics code (XYPLOT)

The codes are designed for access through the system executive. However, the user interface and the analytical codes are provided as separate executable files. You may prepare the input files for the analytical codes manually using a text editor and use the codes without going through the user interface. The instructions for using the codes in this manner are included in the technical manuals for the individual codes.

2.0 Installation Procedures

2.1 System requirements

The CFD industrial codes require OS/2 Version 2.0 or later installed on a PC. The analysis codes are fairly large. To get acceptable performance, a minimum of 8 MB of RAM is recommended. Intel 80386 or 80486SX based machines must have a math coprocessor.

The Browse Utility used to browse and print output files assumes that the printer is connected to the LPT1 port. The plotting program PLOT4DPM will print on any printer specified as the default Printer on the OS/2 Desktop.

2.2 Installation Procedure

To install the industrial codes:

- ❑ Insert Disc 1 in the floppy drive.
- ❑ If you are working in an OS/2 window or full screen session, make the floppy drive the default drive and type **install** to run the installation program. From the OS/2 desktop, open the floppy drive icon in icon view. Double-click on the install.exe icon to start the installation program. The main window of the program is a notebook with three pages as shown in Figure 1.
- ❑ Select the source and destination drives on the Options page.
- ❑ Go to the Install page shown in Figure 2 and click on the Install button to begin installation.
- ❑ Insert the appropriate disc in the drive when prompted to do so.
- ❑ The installation program will terminate automatically when the installation is complete.

The installation program creates an icon labeled "CFD Industrial Codes" on the desktop as shown in Figure 3. Double-click the left mouse button on this icon to start the system executive.

The installation program has been tested on several machines. Limitations of the installation program are as follows:

- ❑ The floppy drive used for installation must be either drive A or B.

- ❑ The destination drives are all installed logical drives starting with drive C. This includes floppy or CD-ROM drives which are not valid destination drives. The program currently only checks for the drives installed on the system but not for the types of drives. It is upto you to select a valid destination drive.
- ❑ If you press F1 to get help while the copy operation is in progress, the help window will not appear until the disc has been copied.

If this version of the installation program does not work on your machine, use the older installation program **Inst16.exe** that is also included on Disc 1.

2.3 Modifications to the OS/2 CONFIG.SYS File

Add "\CFD;" to the "SET HELP =" line. If this is not done, the plotting programs may give a message saying "Help not Available" when they are invoked from the executive. Most programs will work without this modification.

3.0 System Executive

The CFD Executive Program integrates all components of the CFD industrial codes package. The individual codes are accessed through the executive. In addition, the executive provides utility functions such as browsing and printing output files created by the analysis programs, and plotting the data output by some of the industrial codes.

3.1 Using the Executive

The executive is started by double-clicking on the "CFD Industrial Codes" icon on the OS/2 desktop. The main screen is shown in Figure 4. There is a button for each of the seal categories for which codes are available. The codes currently being delivered are in the "Bushing and Ring Seals" (Figure 5), "Face Seals" (Figure 6), and "Other Seal Programs" (Figure 7) categories. The individual codes are accessed by first clicking on the appropriate seal category to bring up the menu of individual codes in that category, and then clicking on a button to execute the desired code.

3.2 Description of Menus

You can exit the executive by double-clicking on the system menu icon or by pressing the **Alt-F4** key combination.

The **File** menu provides facilities to browse, print, and delete data files generated by the analysis codes. Figure 8 shows the File Selection Dialog used by all the programs to specify names of files. The files in the current directory and, when appropriate, the names of subdirectories are listed in a listbox. To select a file name, you have to double click on a name in the file list box to select the file and then press the ACCEPT button. You can switch directories for which the files are listed in the file list box by double clicking on the directory name. When selecting a file to browse or an input data file to read, you may only select a file listed in the listbox. When specifying the name of a file to be saved on disc, you may enter a name in the file name field or select a name listed in the listbox. If the file you specify already exists, you will be asked to confirm that you want to replace the existing file.

When the **Browse File** menu item is selected, the file selection dialog is displayed for you to select the name of the output file to browse. It is your responsibility to ensure that the file you select is an ASCII file. The file you select is then displayed in the

Browse Dialog as shown in Figure 9. You can print the file being browsed by pressing the **Print** button.

When the **Print File** menu item is selected, the file selection dialog is displayed for you to select the name of the file to print. It is your responsibility to ensure that the file you select is an ASCII file. The file is then printed on the printer connected to the **LPT1** port on the computer.

When the **Delete Input Files** menu item is selected, the file selection dialog is displayed for you to select the input file to be deleted. For example, you would select the **\CFD\INPUT\SPIRALGF** directory to display the list of input files for the Gas Lubricated Spiral Groove Face Seals program.

When the **Delete Output Files** menu item is selected, the file selection dialog is displayed for you to select the output file or files to be deleted. Many analysis codes generate several output files with the same name but different extensions. By selecting just one of the files, all files for a particular case can be deleted at once. For example, you would select the **\CFD\OUTPUT\SPIRALGF** directory to display the list of output files for the Gas Lubricated Spiral Groove Face Seals program. When an output file is selected for deletion, you are given the option of deleting only the selected file or all files with the selected file name and any extension.

The **Help** menu provides access to the online help. Context-sensitive help can also be accessed by pressing the **F1** key or a **Help** button if one is available.

4.0 Using the Industrial Codes

All the codes included in this package use a consistent user interface. The menu items available, procedures for using the codes, data entry procedures, etc. are the same for each code. The primary difference between the codes is in the content of input screens used by the different programs. This section describes the various user interface elements used by the codes.

4.1 General Procedures

The **File** menu is used to save input data in a file and read data from a previously saved input file. Figure 10 shows the file menu selections available for each of the industrial codes. The CFD file selection dialog is displayed for you to specify the name of the input data file to be read or saved. Once the data has been read from a file, it can be changed using the normal input procedures. The main screen for the program displays the descriptive title for current data set. *The input data files are saved in binary format and may not be the same as those used by the analysis code.*

The **Help** menu is used to accesse the help system. Context sensitive help is available at all times by pressing the **F1** key. Figure 11 shows the help menu selections available for each of the industrial codes. The help index is available to get help on a specific topic such as an input variable. If you require additional information about the input variables, please consult the manuals provided with the analysis codes.

The **Analysis** menu is used to begin an analysis after input data has been prepared. Figure 12 shows the analysis menu selections available for each of the industrial codes. When the **Run Analysis** menu item is selected, the CFD file selection dialog is displayed for you to specify the name of the output file(s) which will be generated by the analysis code. An existing name may be selected from the file list, or a new name may be input at this time. If entering a new name, you only need to enter an eight character file name. The program supplies the appropriate extension(s). The analytical program is then started as a separate process in its own window. The message "Analysis in progress..." is displayed in the program's main window until the analysis is completed. Once the analysis is running, the user interface is available for use. You may not, however, start a another analysis while a previous one is in progress. Status messages from the analytical code that is running may be viewed by switching to the analytical code's window.

A batch mode which allows sequential execution of up to 5 test cases has been provided. When the **Batch Mode** menu item in the analysis menu is selected, the screen shown in Figure 13 is displayed to enter the input, output, and, if applicable, pressure file names for up to 5 cases. Only the file names and extensions need to be entered. A listbox containing the available input and output files is displayed at the bottom of the screen for viewing. The program will check to ensure that the input files you supplied are exist. The names of the pressure files may be required for GCYL, GFACE, ICYL, and IFACE. It is your responsibility to ensure that the pressure file exists or will be created by the output from one of the test cases that will be run before the pressure file is used.

The **View** menu in each program is used to browse program input, program output, and, if applicable, to plot data. Figure 14 shows the view menu selections available for each of the industrial codes. You are restricted to browsing and plotting files in the output file directories of the program you are using. The input view is based on current values entered by the user and is displayed in the format used by the analysis code.

You can **Exit** a program by double-clicking on the system menu icon. If an analysis is in progress when you exit, you will be given the option to abort the analysis and exit or to cancel your request to exit.

4.2 Data Input Procedures

The **Input** menu is used to input data. The menu items are essentially the same for each program. The input menu options for the GCYL code are shown in Figure 15. Selecting a menu item brings up a screen with the relevant input fields. The displayed input screen may hide or disable certain fields depending upon values that were entered on other input screens. When you are done with the input, press the **Accept** button to save the changes you made or the **Discard** button to keep the old values. The purpose of the input screens for each of the menu items is described below using GCYL as an example.

Analysis Options are used to define the scope of the analysis to be performed, and to define the title and units to be used for the input case. Figure 16 shows the ANALYSIS OPTIONS screen with default values. Mutually exclusive options such as Calculate Stiffness are shown as radiobuttons with the current choice highlighted. You can select only one of the options in a group of radiobuttons. Other options such as Boundary conditions allow several elements to be selected at the same time. These are shown as checkboxes. When you click on a checkbox, a checkmark appears to show that it has been selected. You must click on it again to deselect it. To get help on the choices

available in an option, select the option and press the F1 key. Help screen for the Calculate Stiffness option is shown in Figure 17. The Analysis Options always contains an option to choose between SI and English units. The units displayed in the field labels and the numeric values will be automatically changed to the correct units. The SI and English units for frequently used quantities are as follows:

DESCRIPTION	SI UNITS	ENGLISH UNITS
Lengths	m or mm	in
Angular Velocity	rev/min or rad/s	rev/min or rad/s
Velocity	m/s	in/s
Forces	N	lb
Gas Constant	m**2/(s**2-deg K)	in**2/(s**2-deg R)
Temperature	deg K	deg R
Density	kg/m**3	lbm/in**3
Viscosity	Pa.s	lb-s/in**2
Pressure	Pa	psia or psig
Entropy	J/Kg-K	Btu/lbm-R
Inertia	Kg.m**2	lbm.ft**2
Moments	N.m	in.lb
Angles	deg or rad	deg or rad
Energy	J	ft.lb
Power	W	ft.lb/s
Stiffness	N/m	lb/in

The **Seal Geometry** screen is used to specify seal dimensions as shown in Figure 18 with default values. The values are entered in the entry fields. If a field is not needed because of the analysis options selected, it is disabled to prevent you from entering data in that field. To get help for an entry field, press the F1 key while the cursor is positioned in the field. When you press the ACCEPT button to save the current values displayed on the screen, the values are checked to ensure that they are in an acceptable range.

The **Operating Conditions** screen is used to specify operating parameters such as speed, temperature, eccentricity, and pressures as shown in Figure 19 with default values.

The **Seal Configuration** screens are used to specify special features such as fluid sources, rayleigh steps, spiral grooves, etc. These screens will, therefore, differ significantly from code to code. Figure 20 shows the screen for specifying flow line coordinates in GCYL. A flow line is a grid line with specified grid coordinate boundaries (X1, Y1) and (X2, Y2). The lines are specified as an array of starting and ending grid coordinates for the lines. Four sets of values in the array are displayed on the screen. You can scroll through the array using the scroll bar. When the number of lines is entered in the entry field and the cursor is moved to one of the fields in the array, the scroll bar will adjust its range to match the number of lines specified.

The **Grid Definition** screen used to define the grid used in the numerical solution is shown in Figure 21 with variable grids turned on for both axial and circumferential grids. The default is to turn off variable grids. The arrays used for variable grid are disabled if they are not required.

The **Properties** screen shown in Figure 22 is used to input seal fluid properties such as viscosity and specific heat ratio.

The **Solution Control** screen shown in Figure 23 is used to input information such as tolerance and number of iterations used to control the numeric solution.

The **Set Defaults** option is used to set values in all the screens to system defaults for the program.

4.3 Utility Programs

PLOT4DPM is used to plot HPF files generated by GCYL, GFACE, ICYL, and IFACE. XYPLOT is used to plot output data from the seal dynamics code. FLUID is used to calculate fluid properties of gases and saturated vapor. The user interfaces for these codes are unique to the codes. The procedures for using these codes are documented in the on-line help.

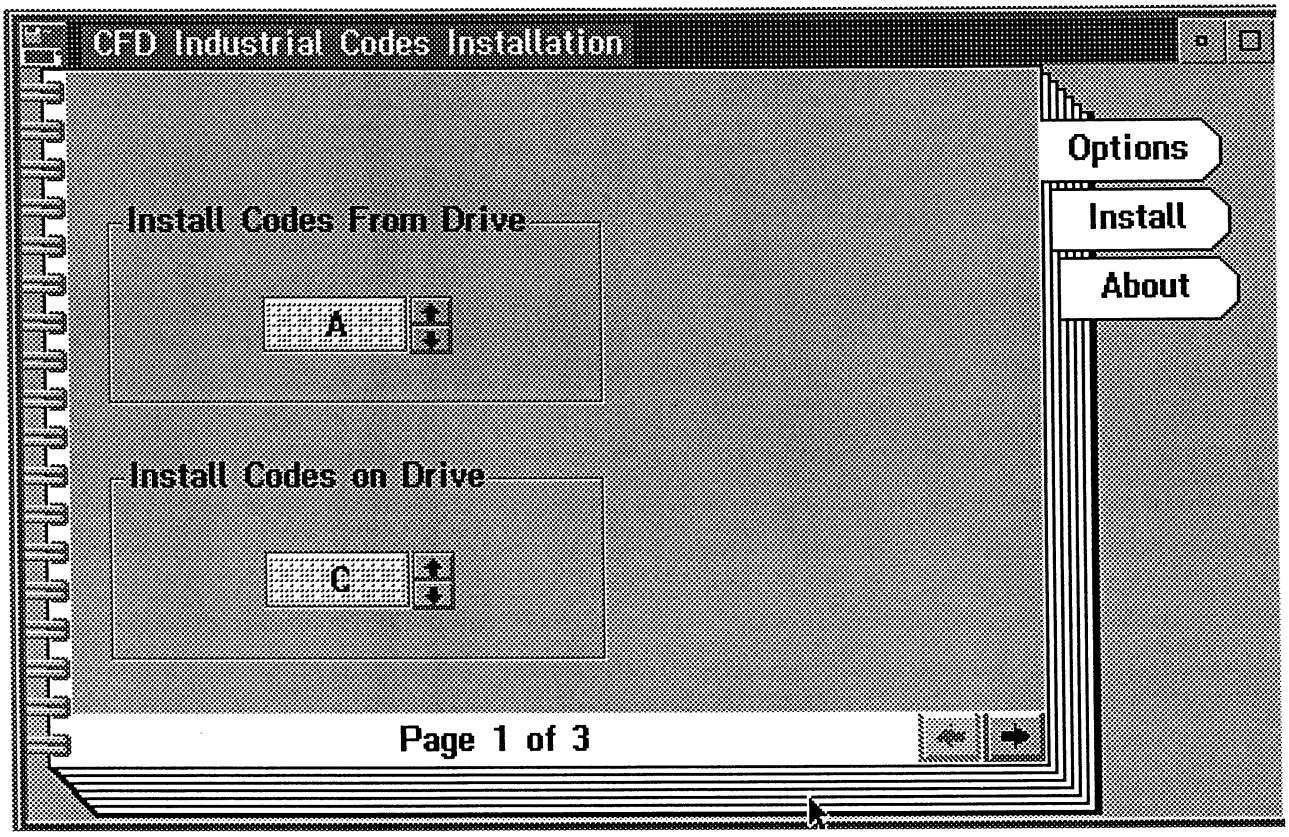


Figure 1: Installation Program - Options Page

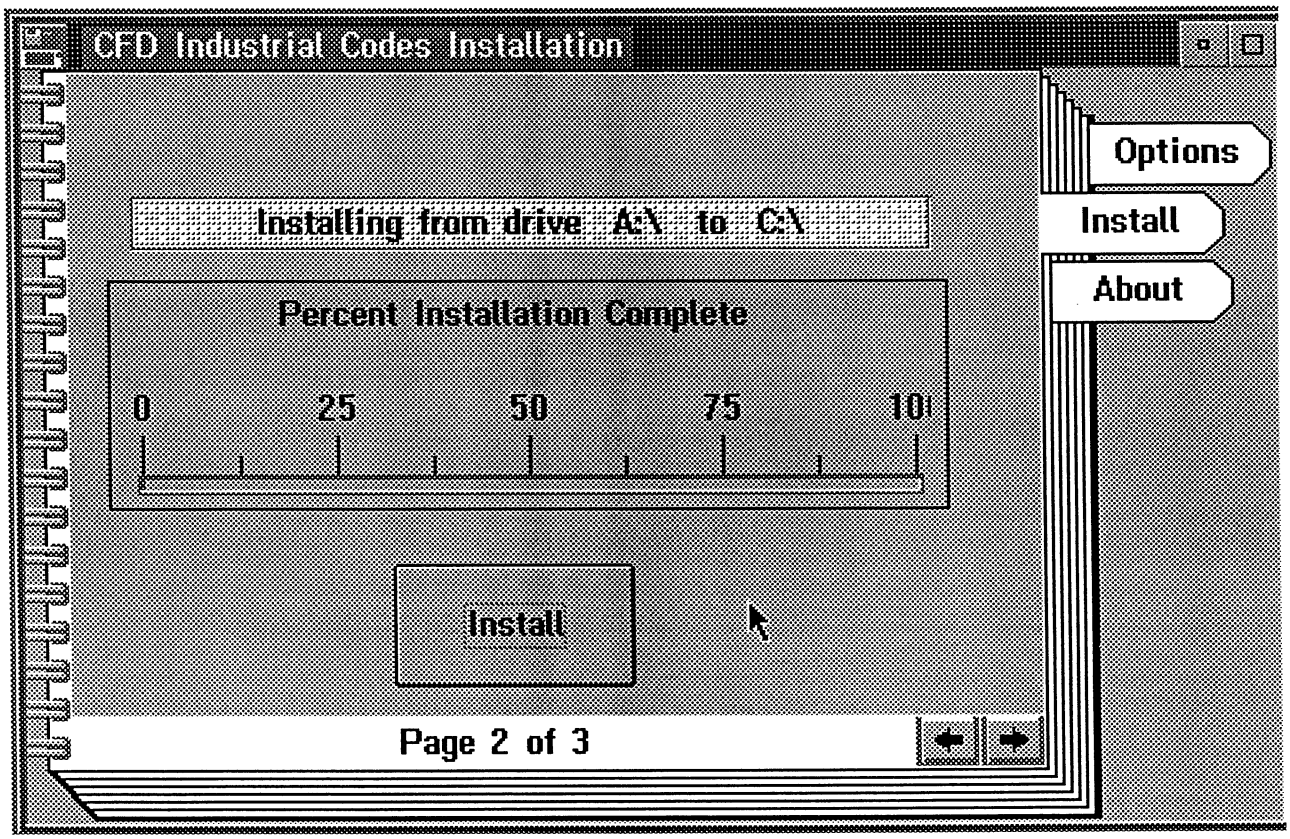


Figure 2: Installation Program - Install Page

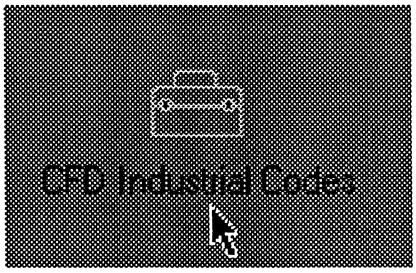
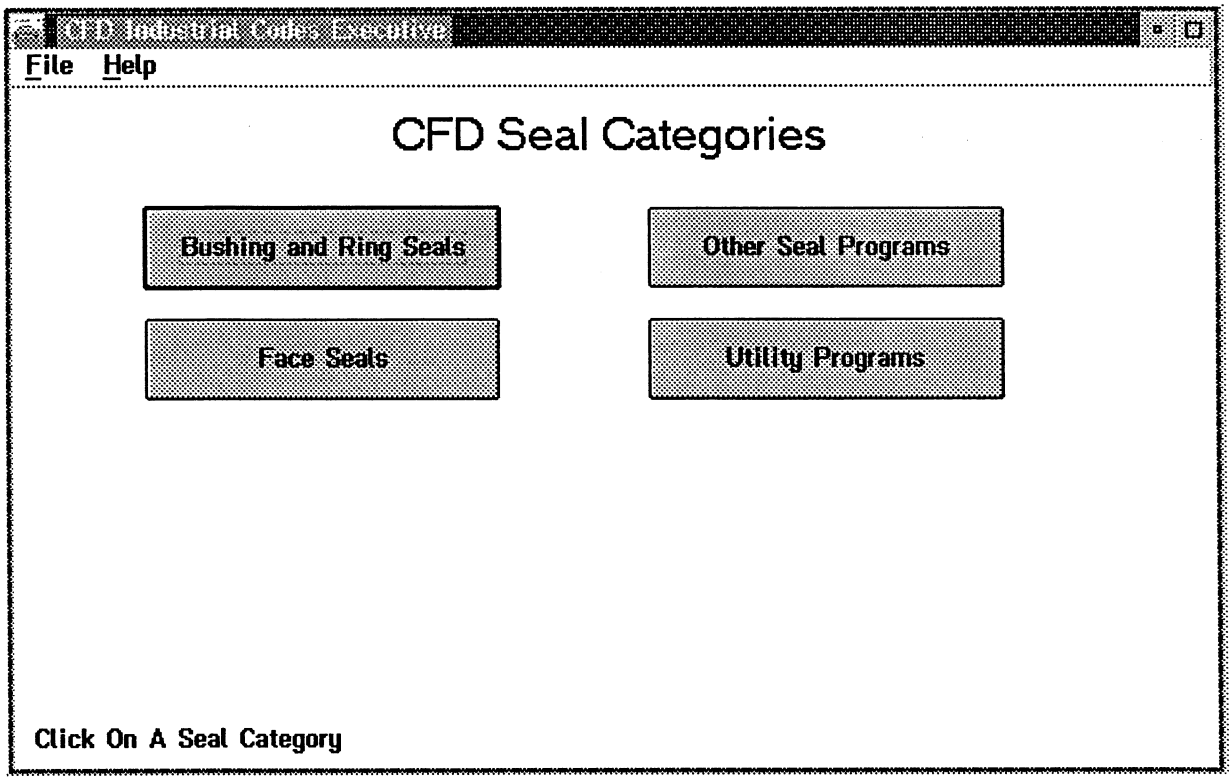
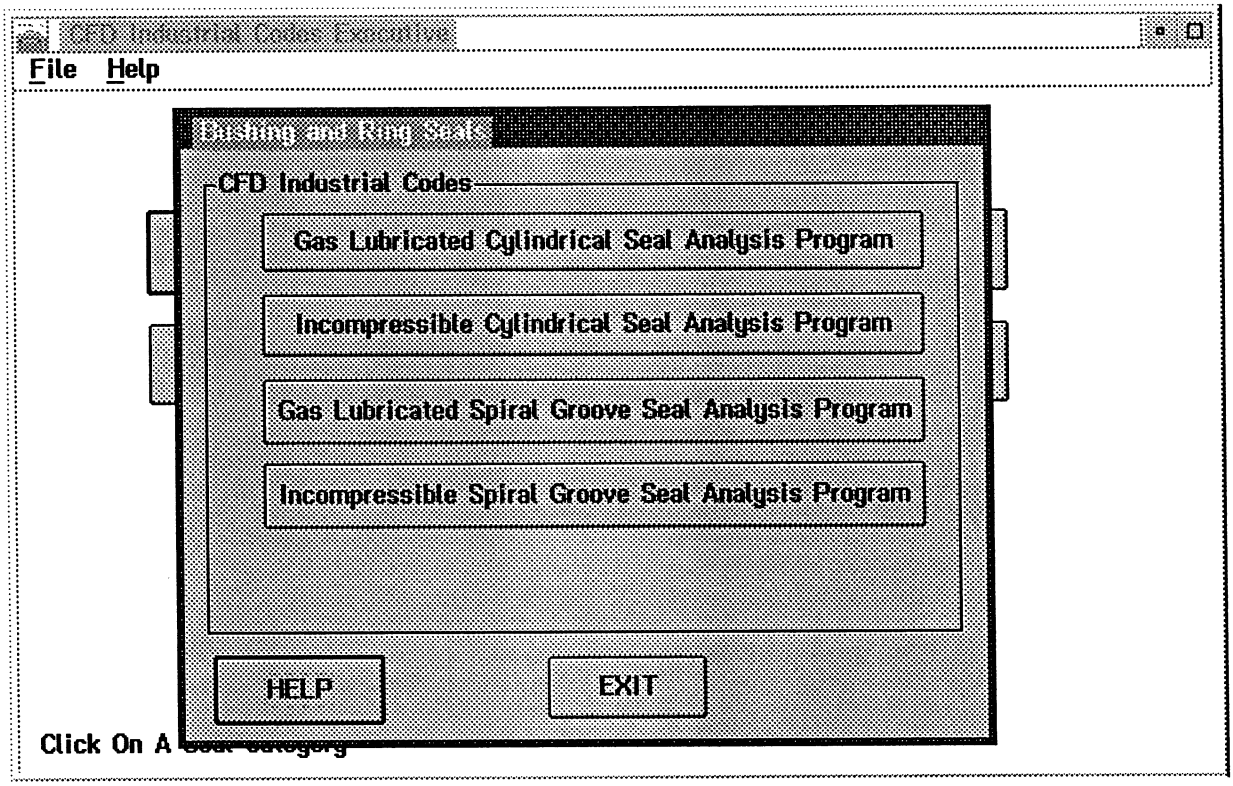
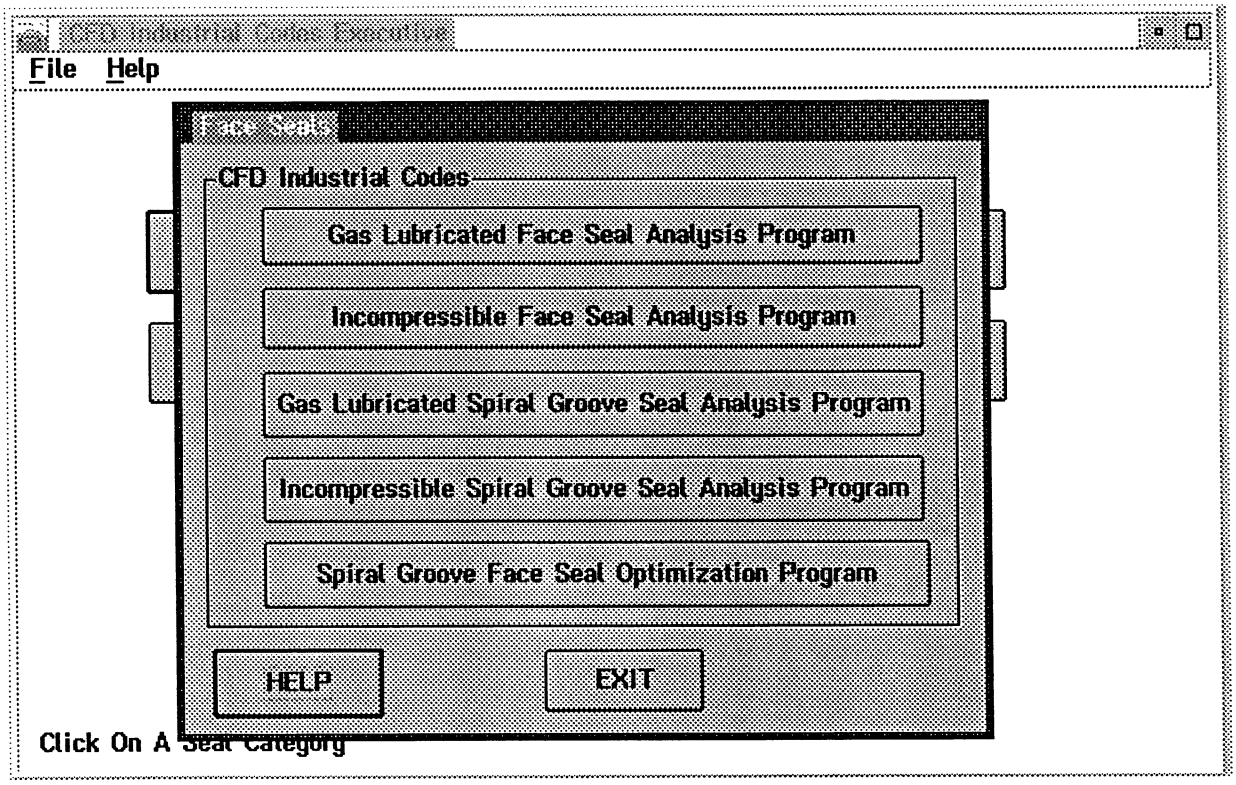
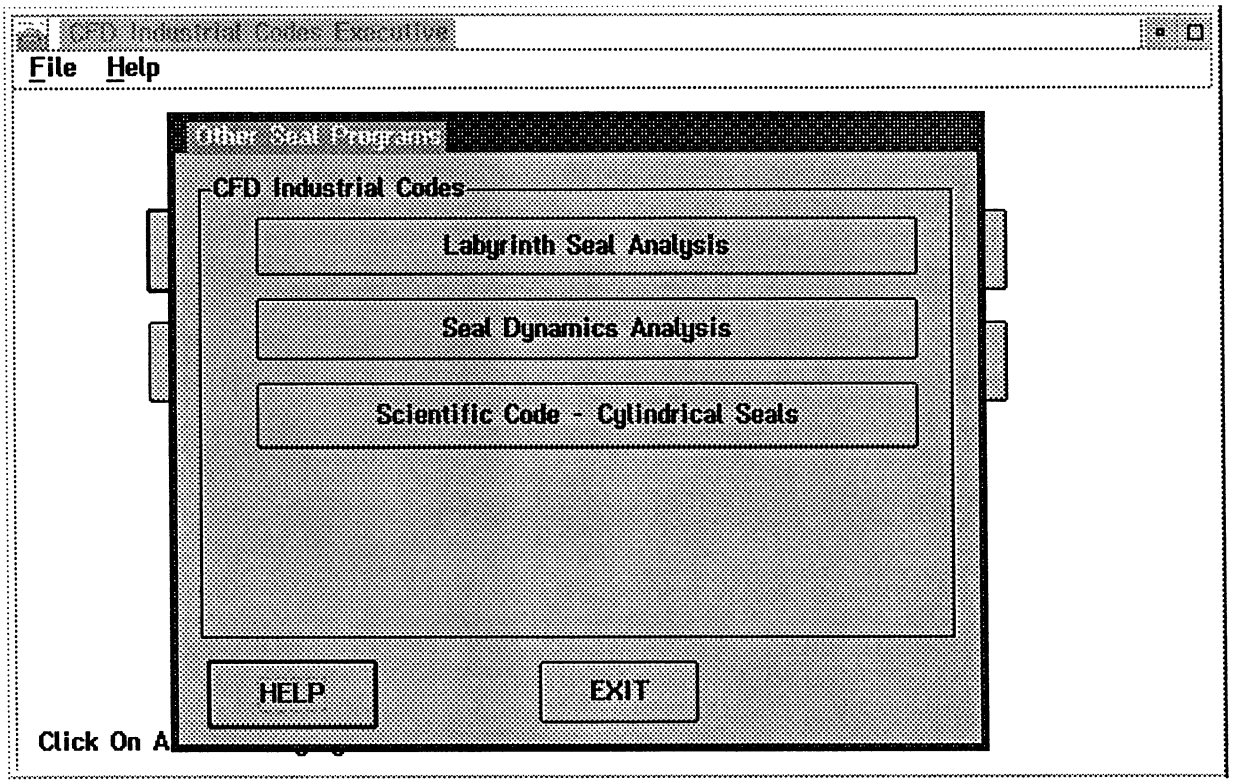


Figure 3: CFD Industrial Codes Icon on the OS/2 Desktop


CFD Industrial Codes Executive
File Help
CFD Seal Categories
Bushing and Ring Seals
Other Seal Programs
Face Seals
Utility Programs
Click On A Seal Category


File Help
Bushing and Ring Seals
CFD Industrial Codes
Gas Lubricated Cylindrical Seal Analysis Program
Incompressible Cylindrical Seal Analysis Program
Gas Lubricated Spiral Groove Seal Analysis Program
Incompressible Spiral Groove Seal Analysis Program
HELP
EXIT


File Help
Face Seals
CFD Industrial Codes
Gas Lubricated Face Seal Analysis Program
Incompressible Face Seal Analysis Program
Gas Lubricated Spiral Groove Seal Analysis Program
Incompressible Spiral Groove Seal Analysis Program
Spiral Groove Face Seal Optimization Program
HELP
EXIT
Click On A Seal Category


File Help
Other Seal Programs
CFD Industrial Codes
Labyrinth Seal Analysis
Seal Dynamics Analysis
Scientific Code - Cylindrical Seals
HELP
EXIT
Click On A

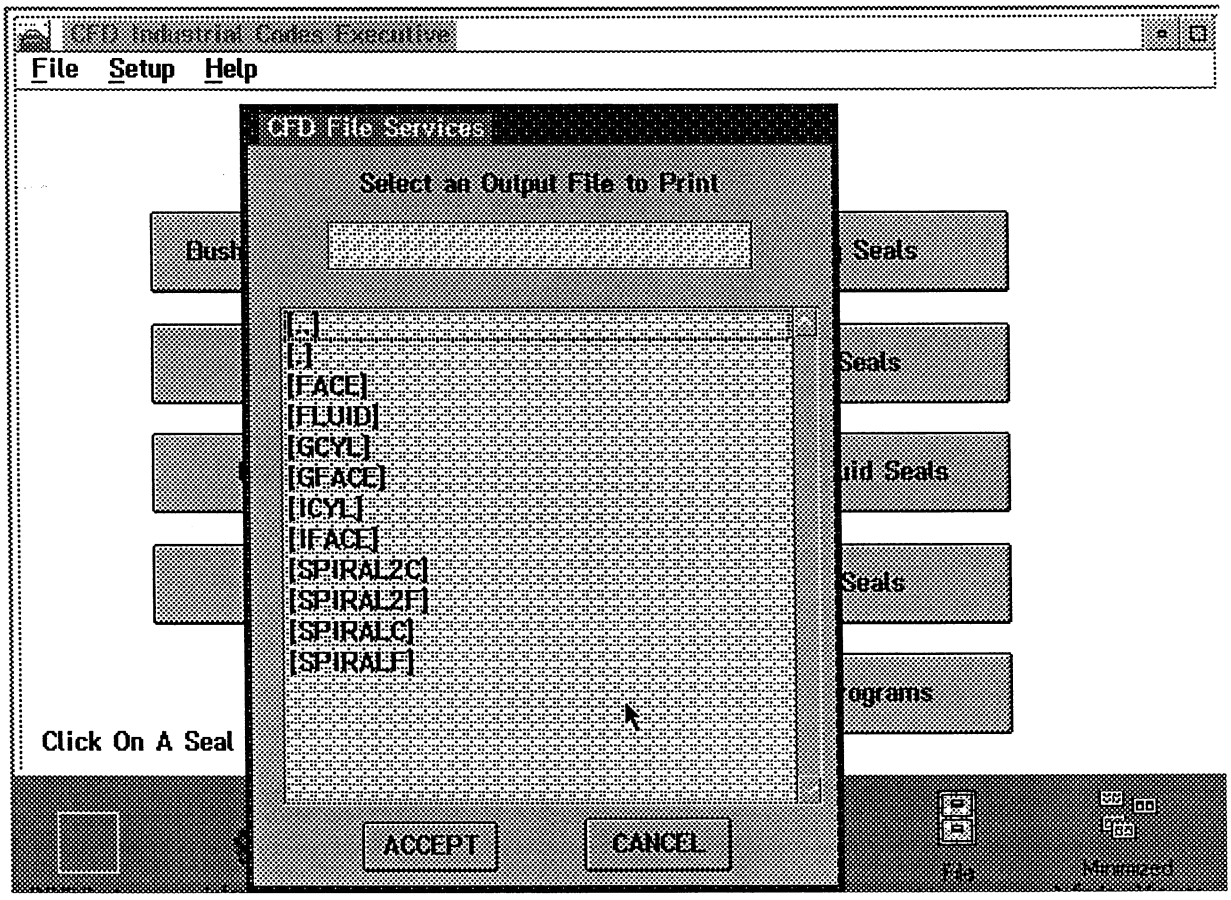


Figure 8: File Selection Utility

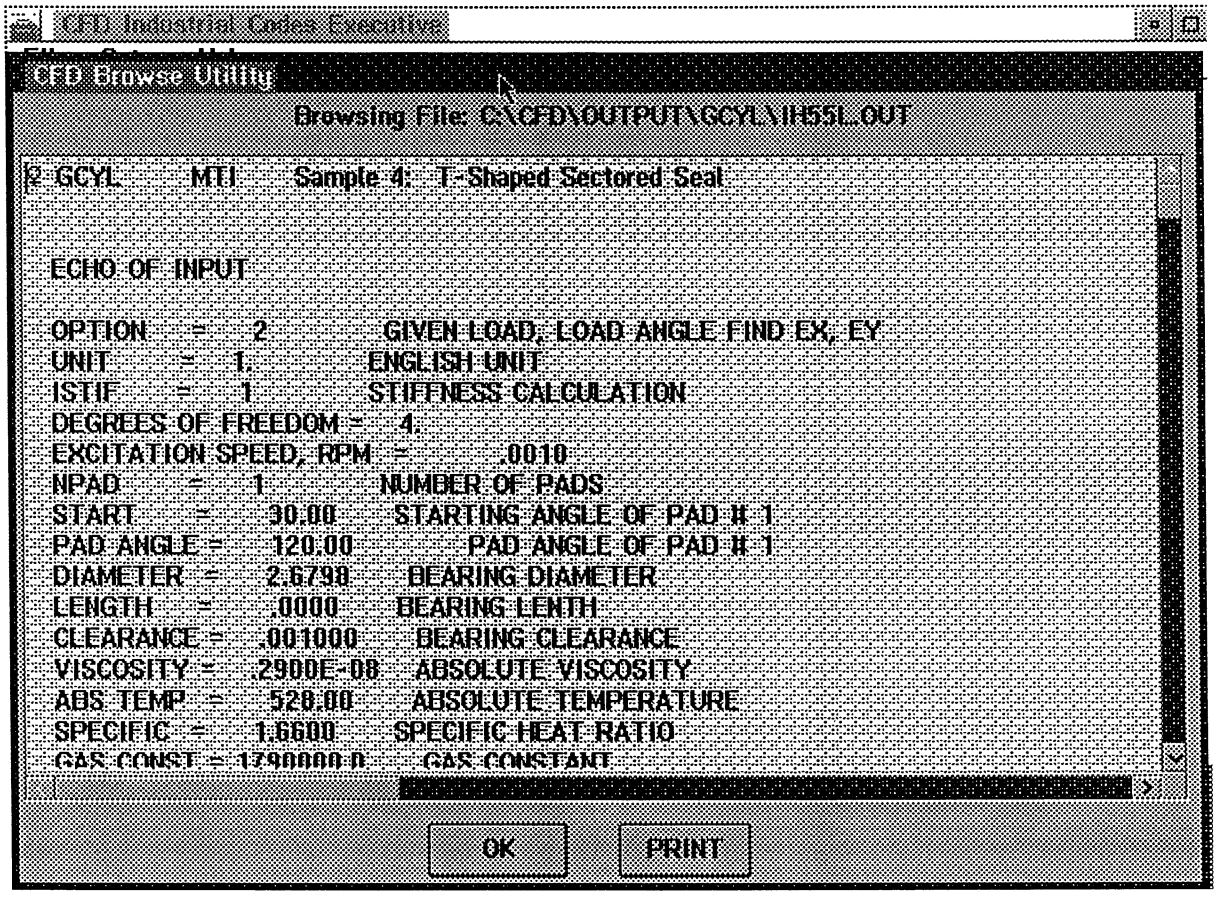


Figure 9: Browse Utility

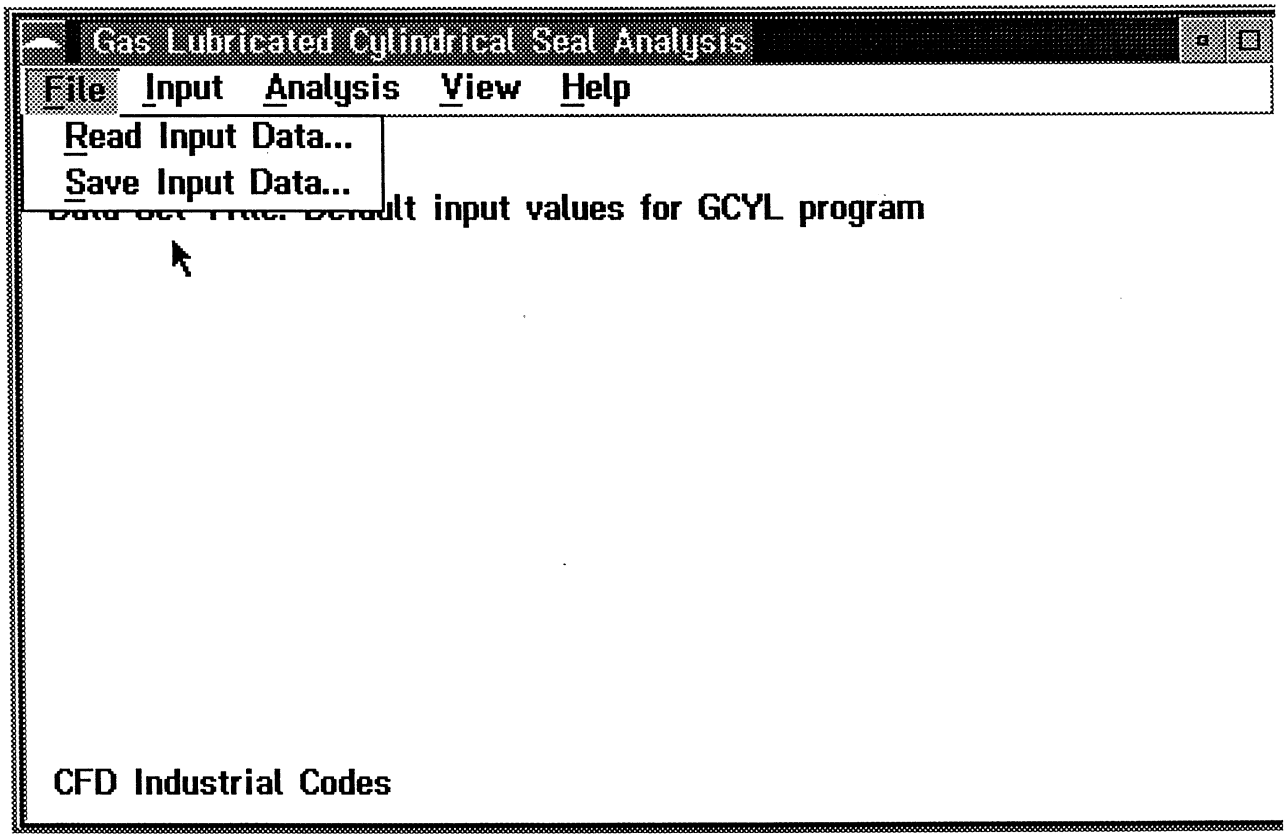


Figure 10: File Menu in Industrial Codes

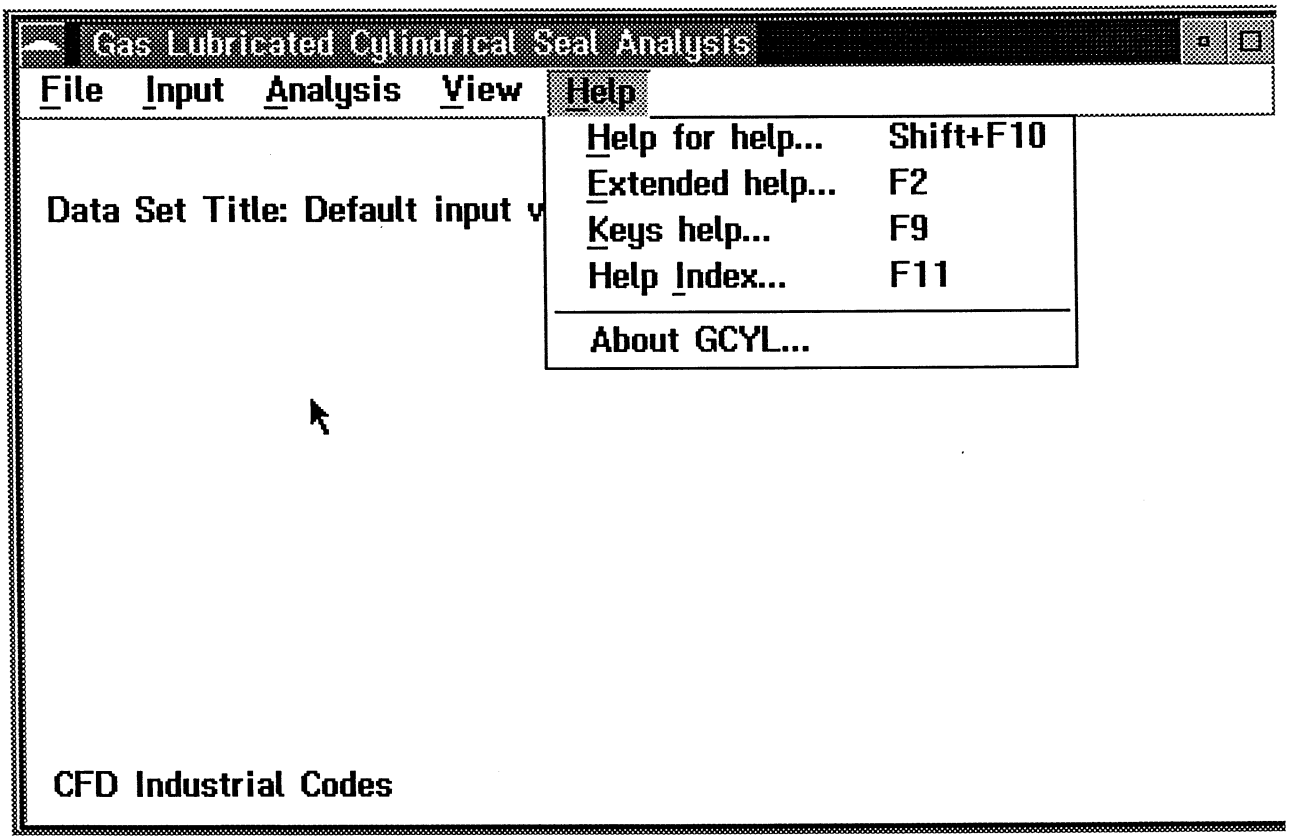


Figure 11: Help menu in Industrial Codes

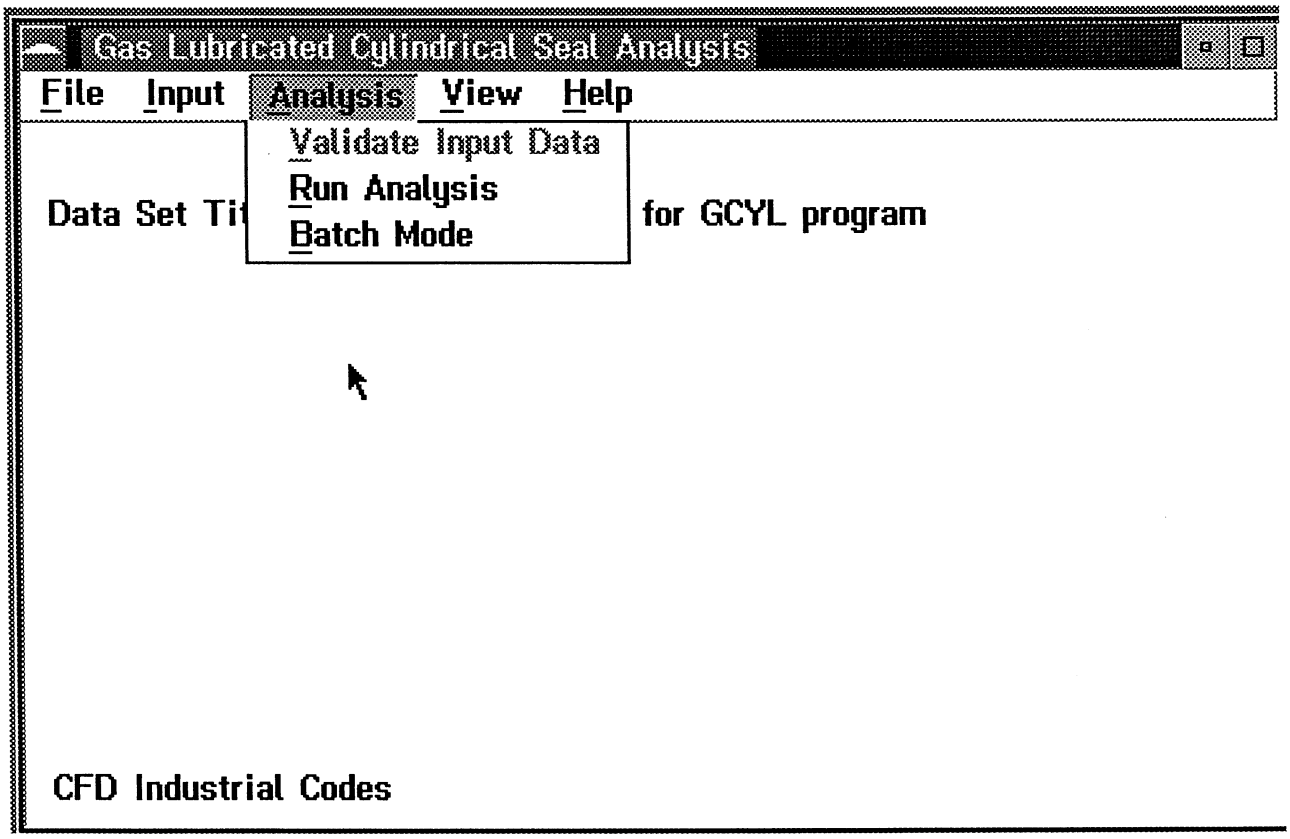


Figure 12: Analysis Menu in Industrial Codes

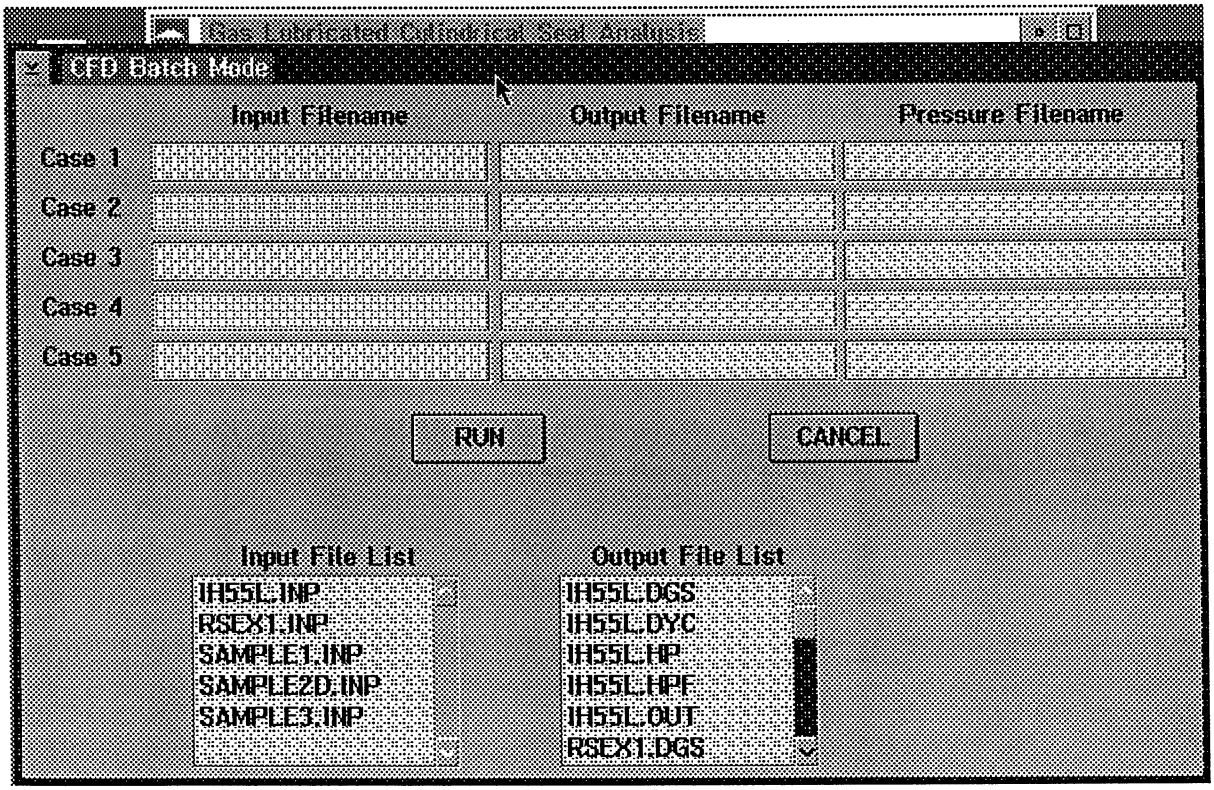


Figure 13: Batch Mode Analysis Input Screen

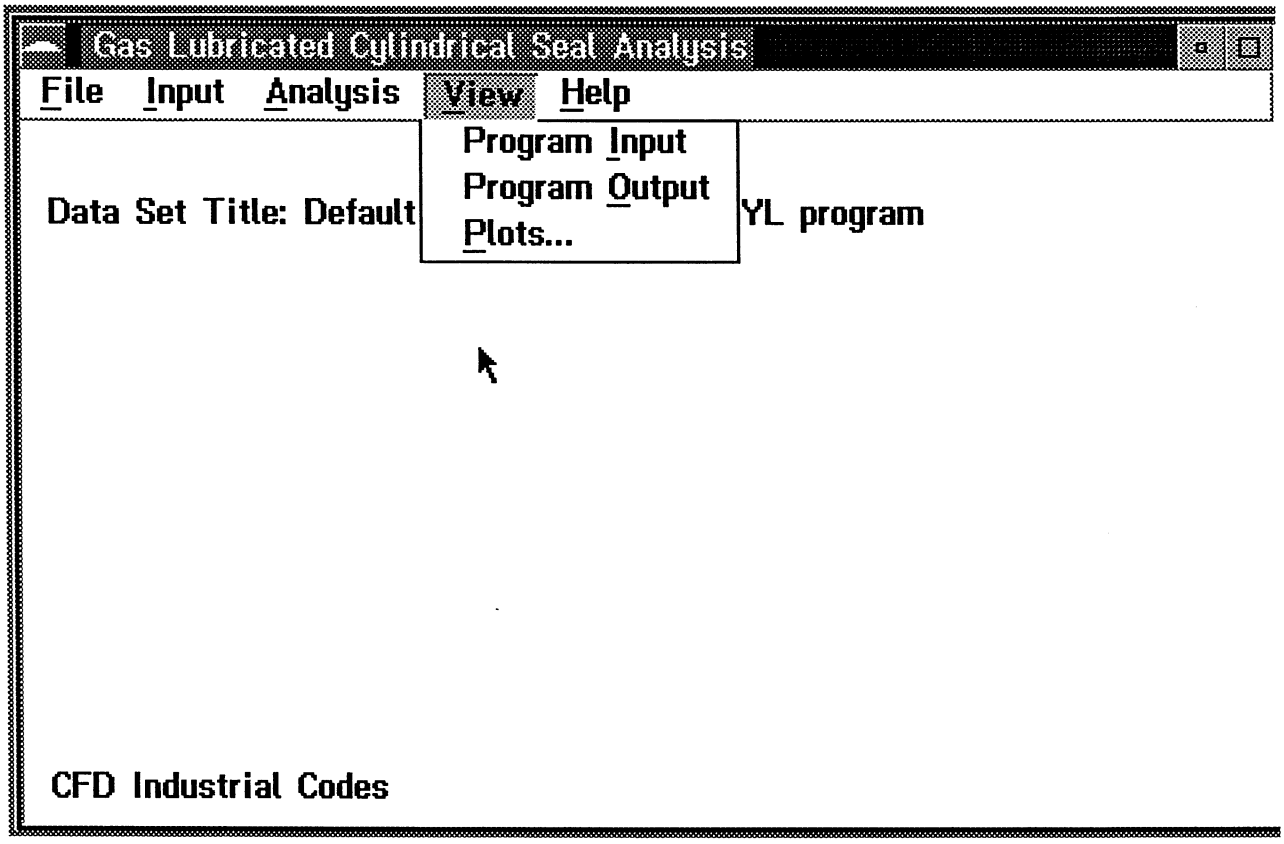


Figure 14: View Menu in Industrial Codes

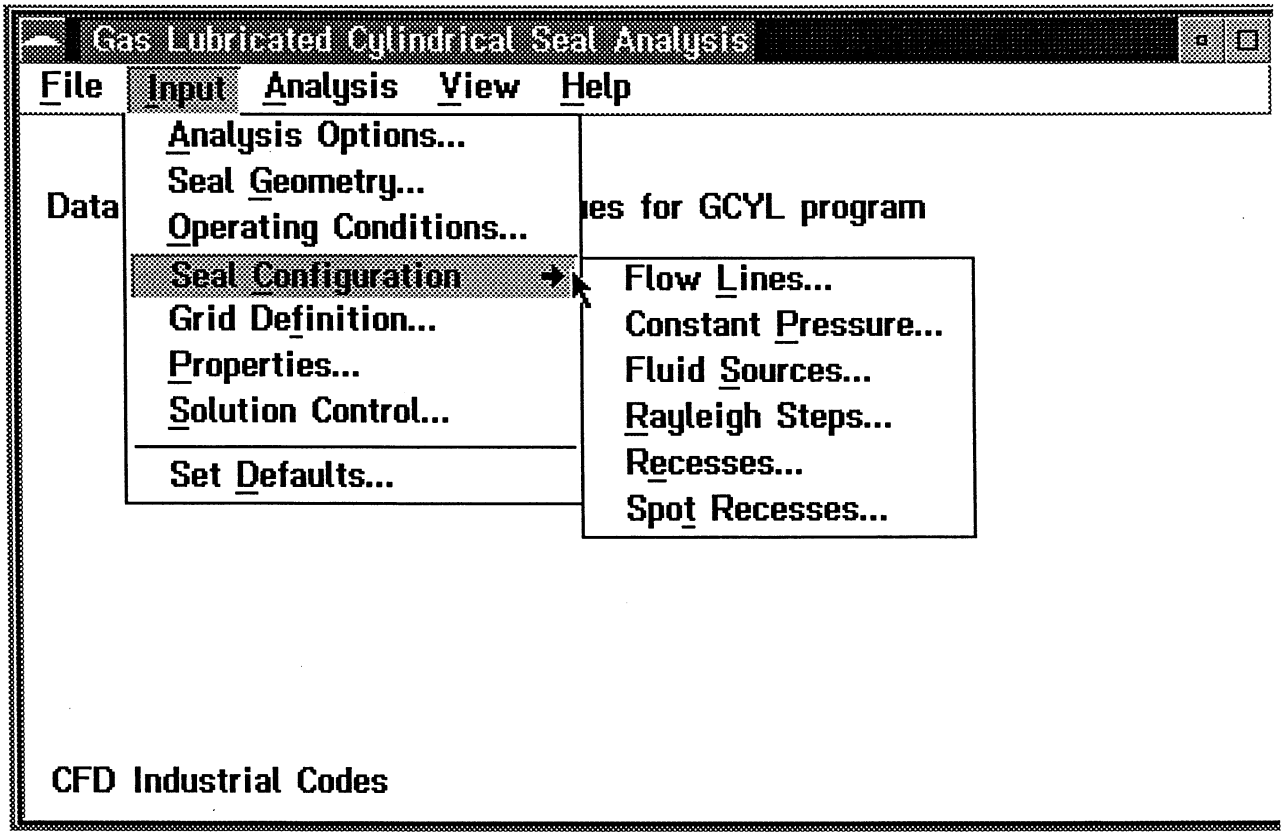


Figure 15: Main Screen and Input Menus for GCYL

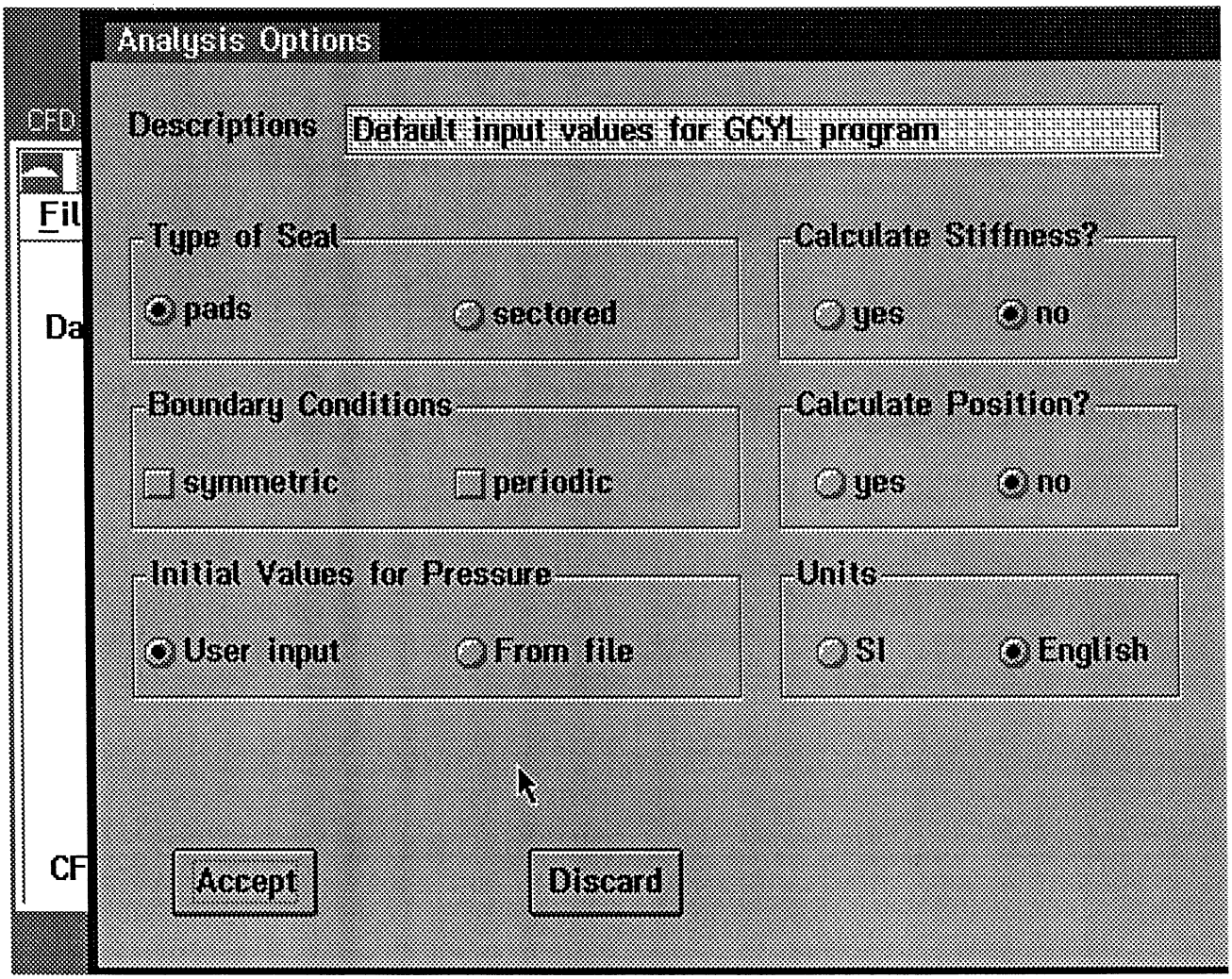


Figure 16: Analysis Options Screen for GCYL

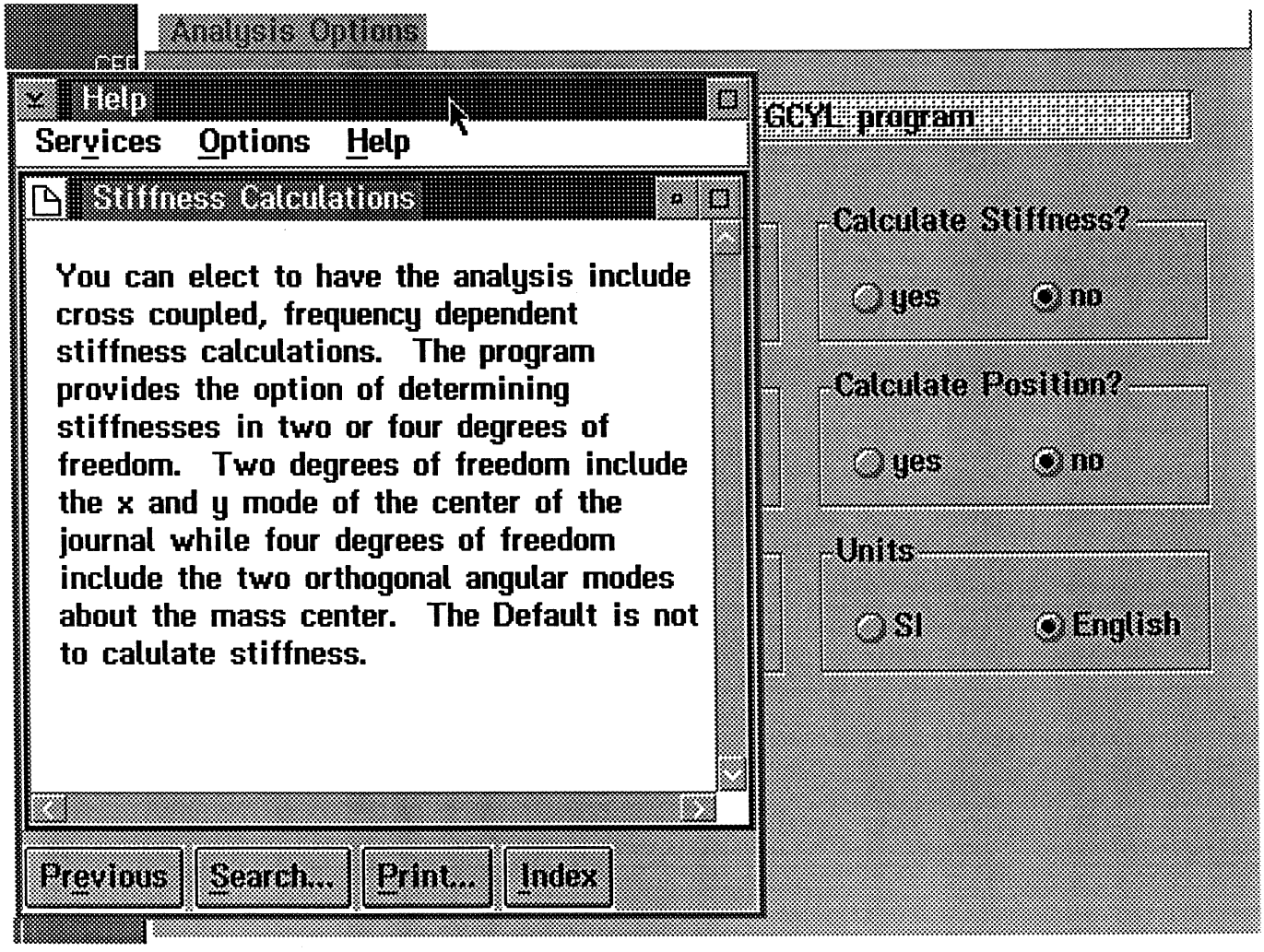


Figure 17: Context Sensitive Help

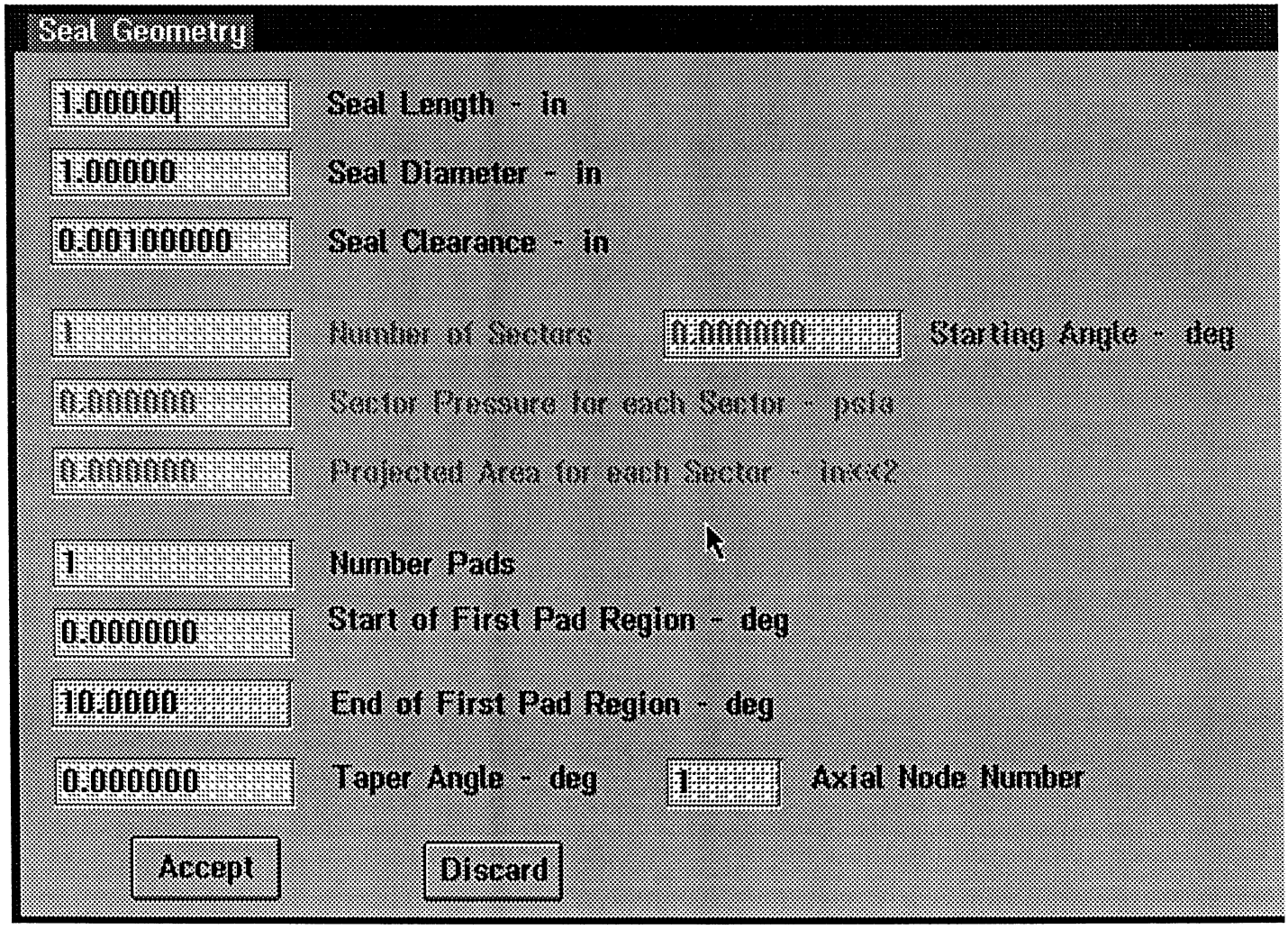


Figure 18: Seal Geometry Screen for GCYL

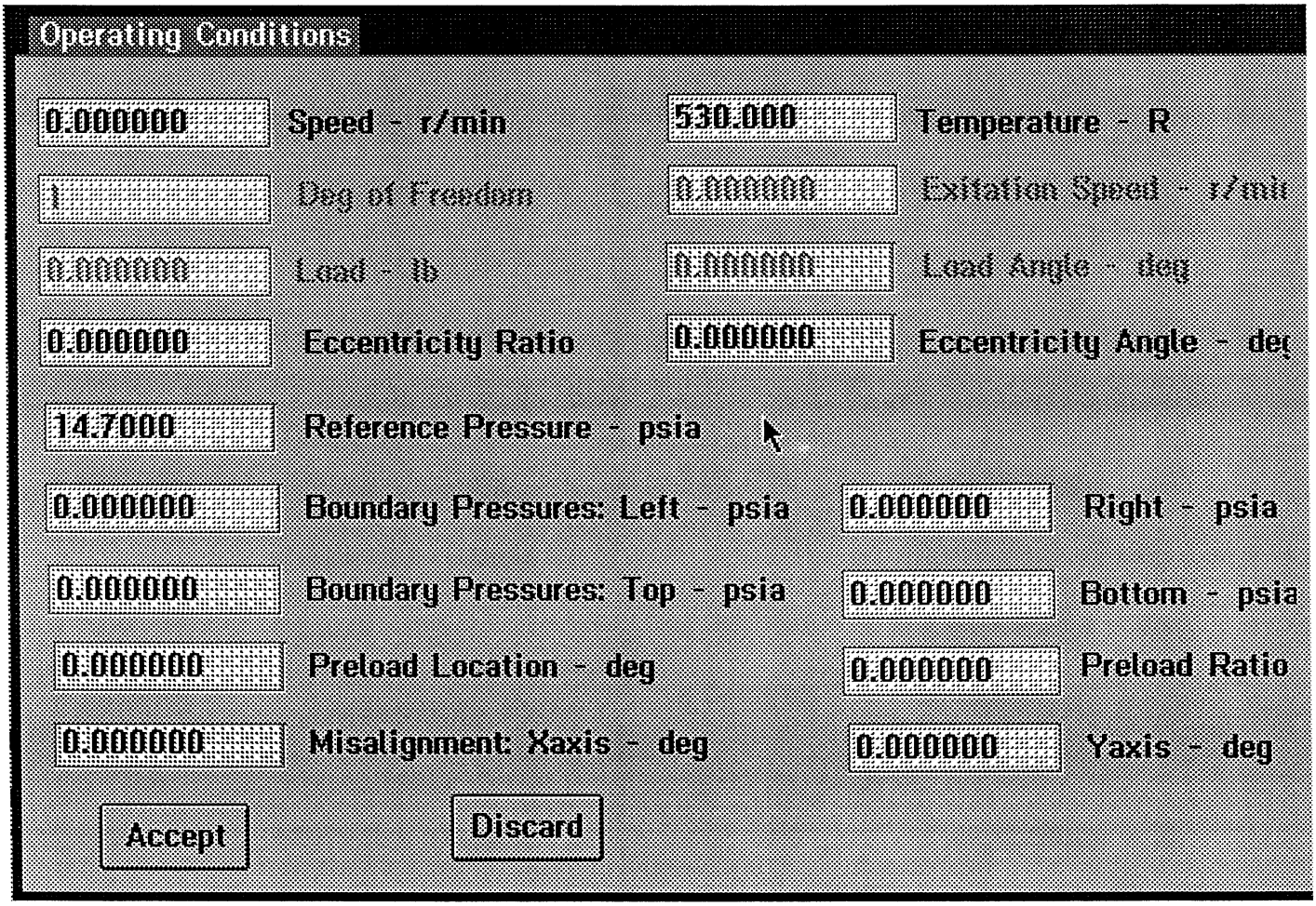


Figure 19: Operating Conditions Screen for GCYL

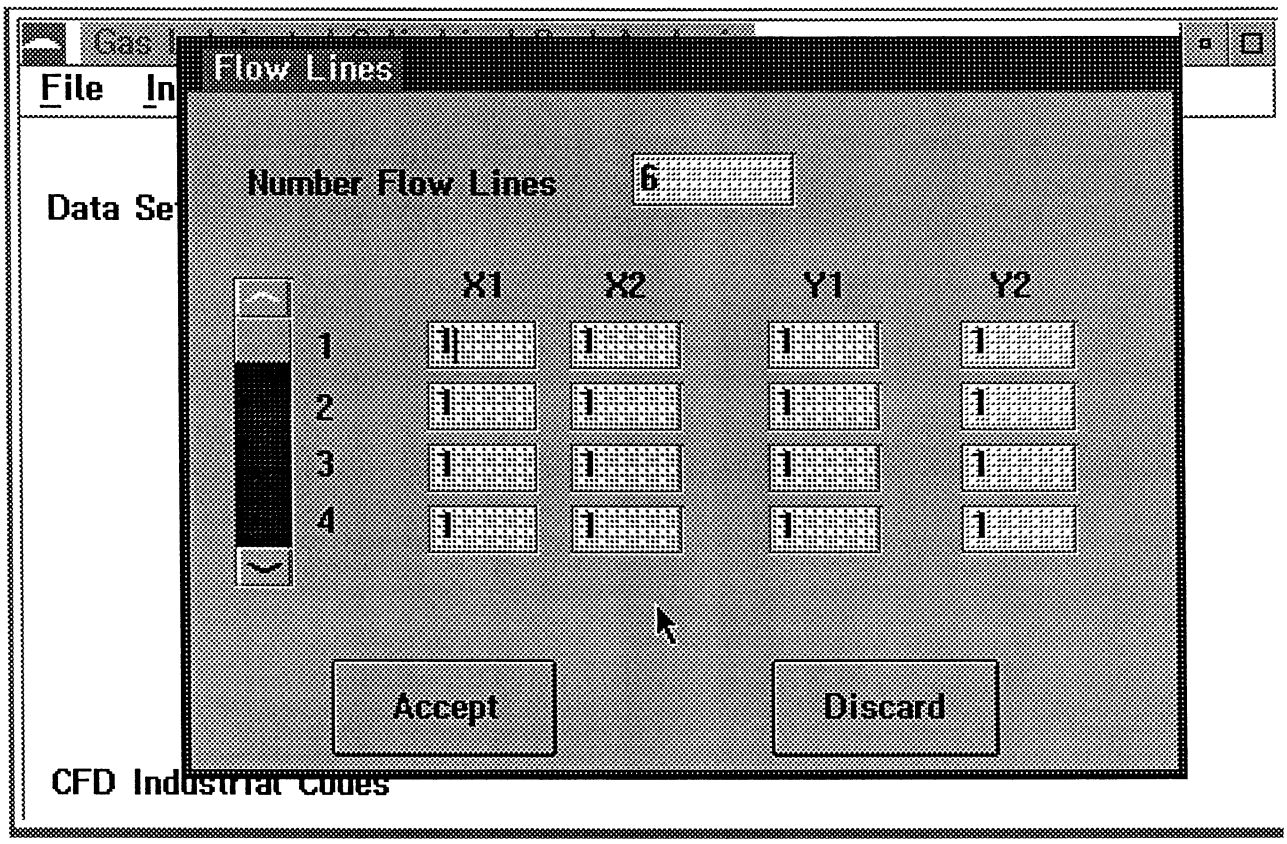


Figure 20: Seal Configuration Screen for GCYL

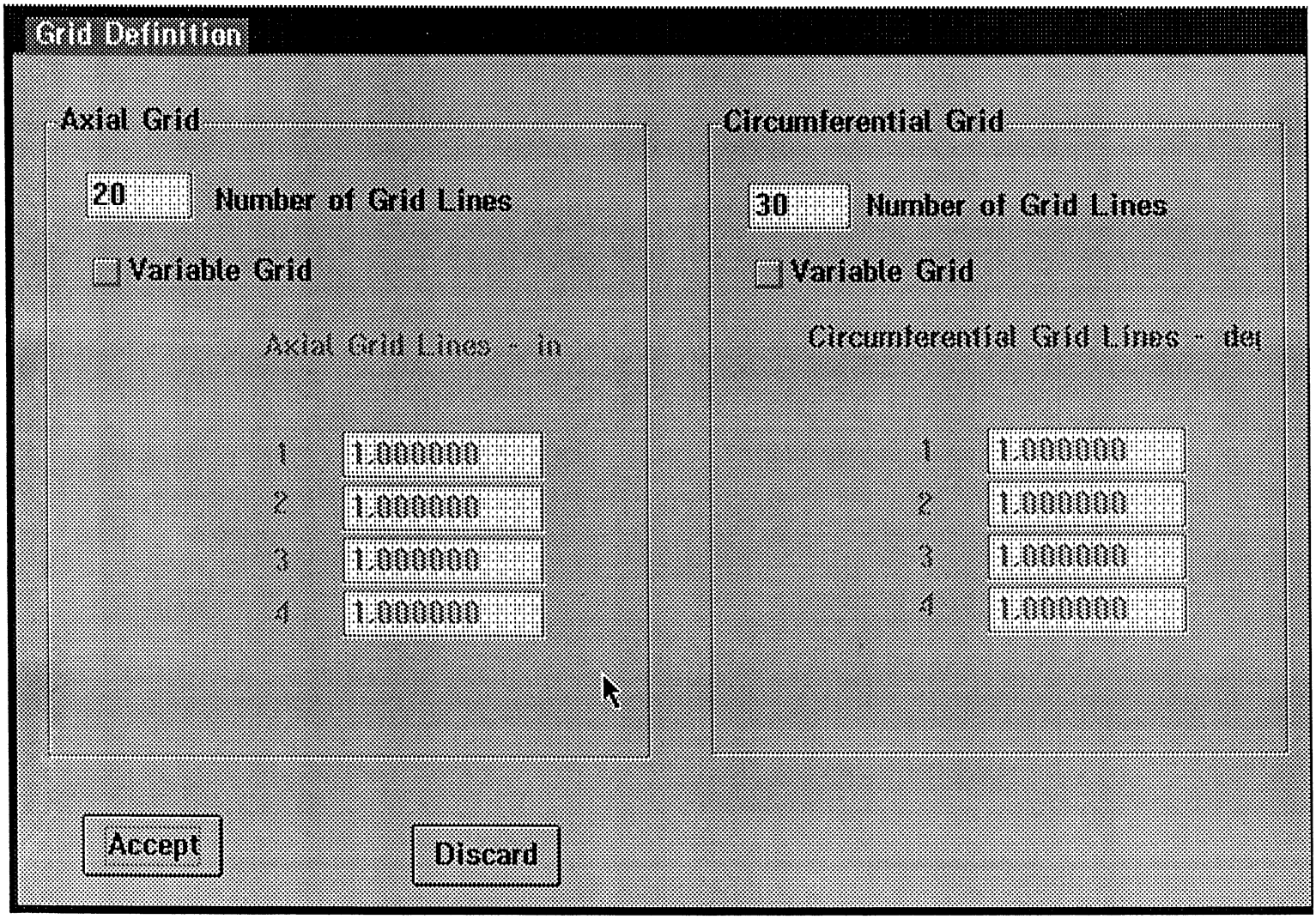


Figure 21: Grid Definition Screen for GCYL

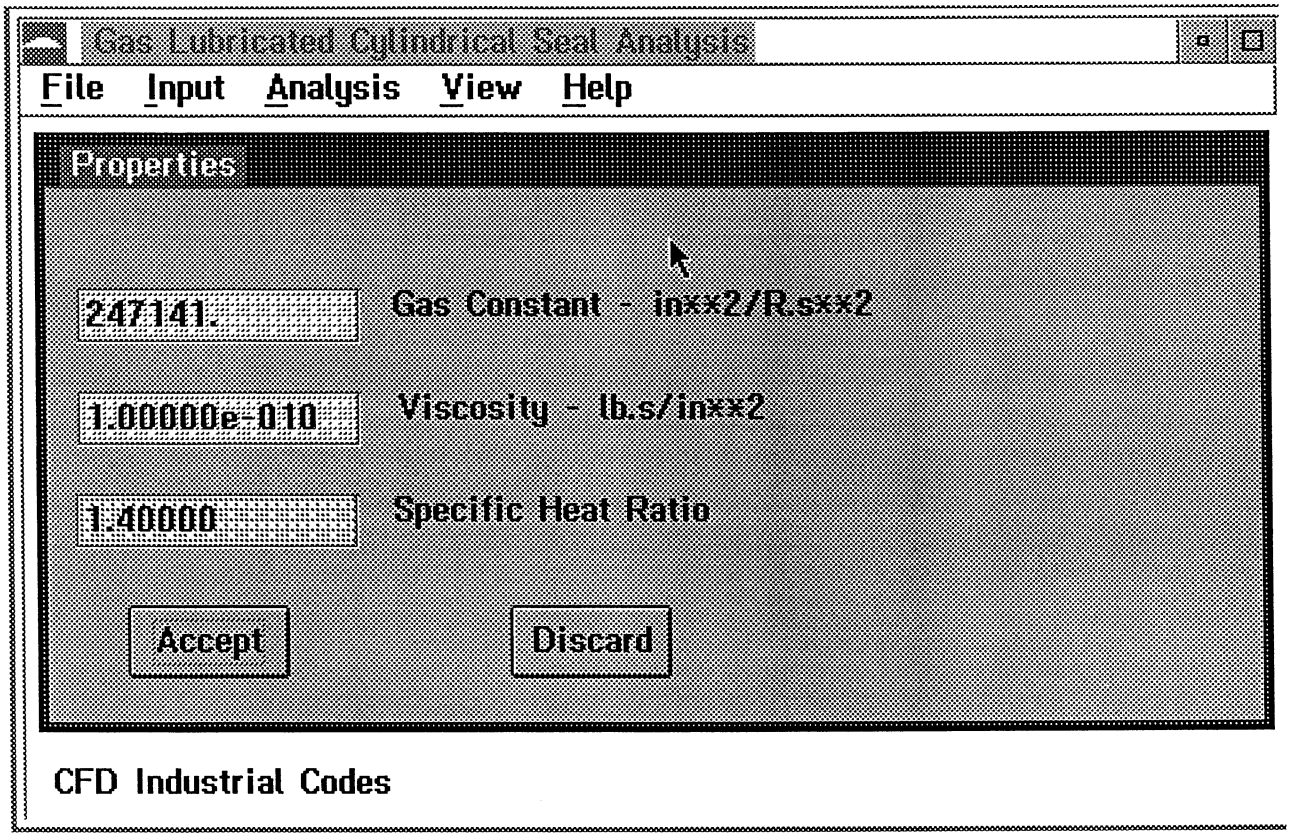


Figure 22: Seal Fluid Properties Screen for GCYL

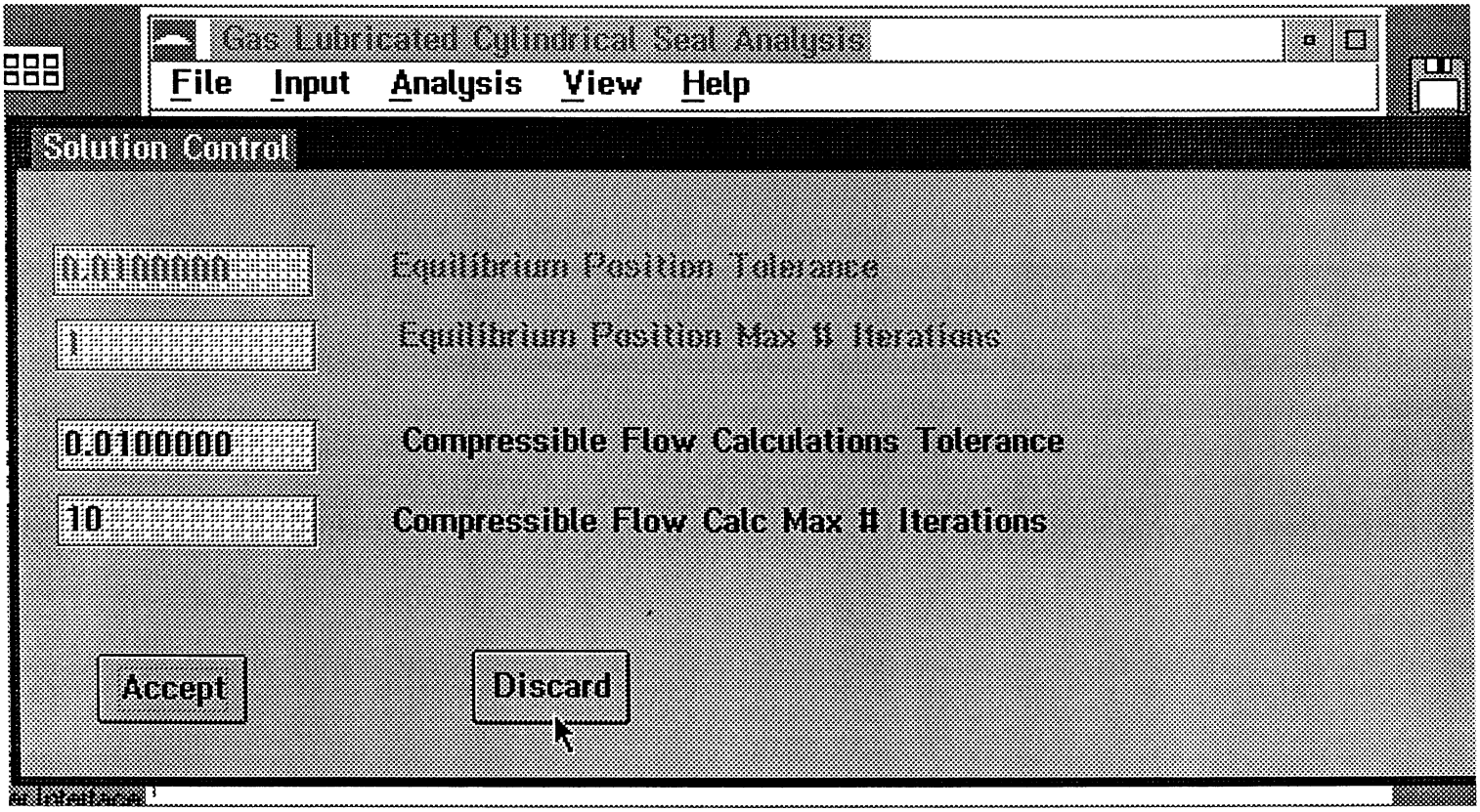


Figure 23: Solution Control Screen for GCYL

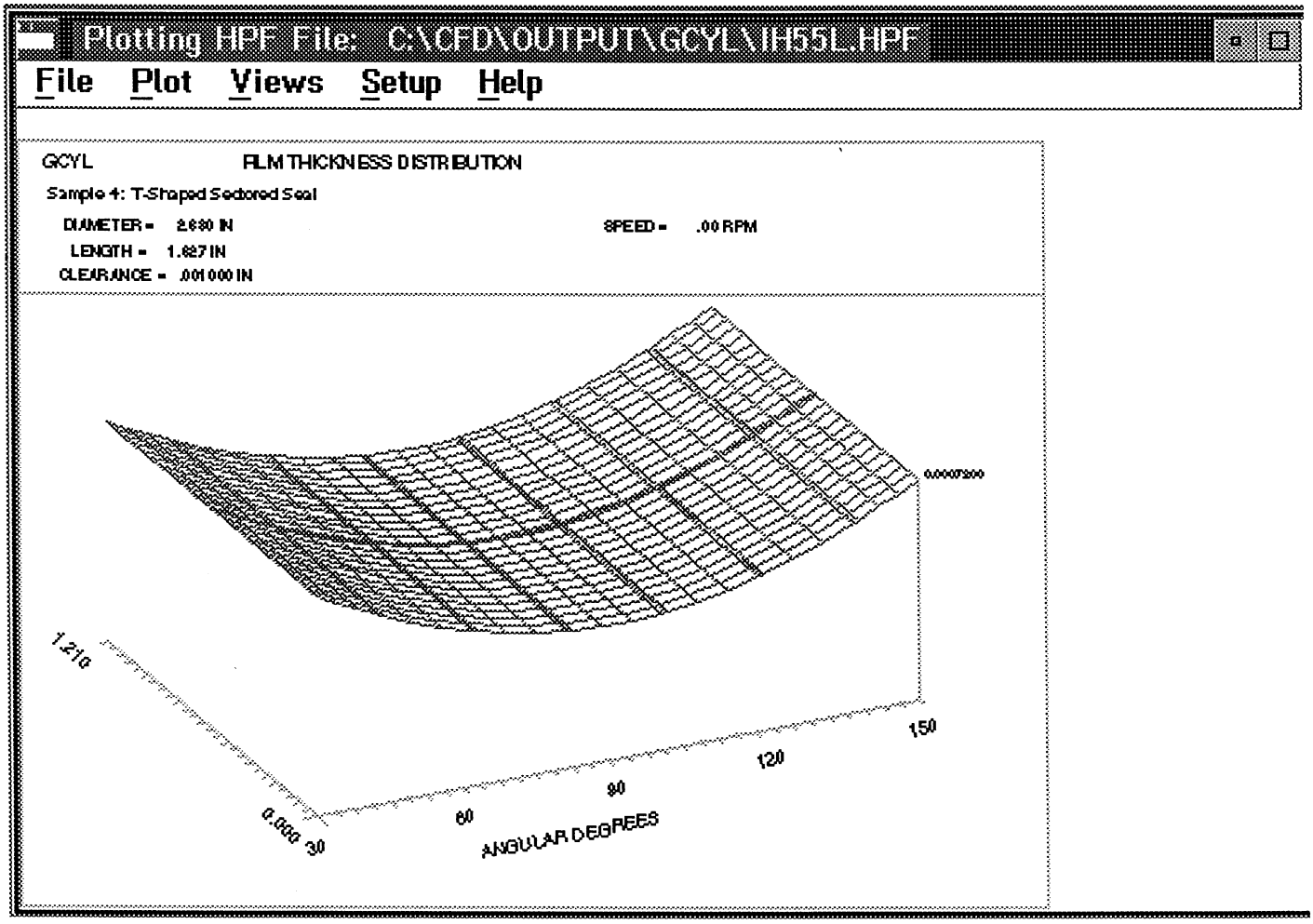


Figure 24: PLOT4DPM - Film Thickness Plot

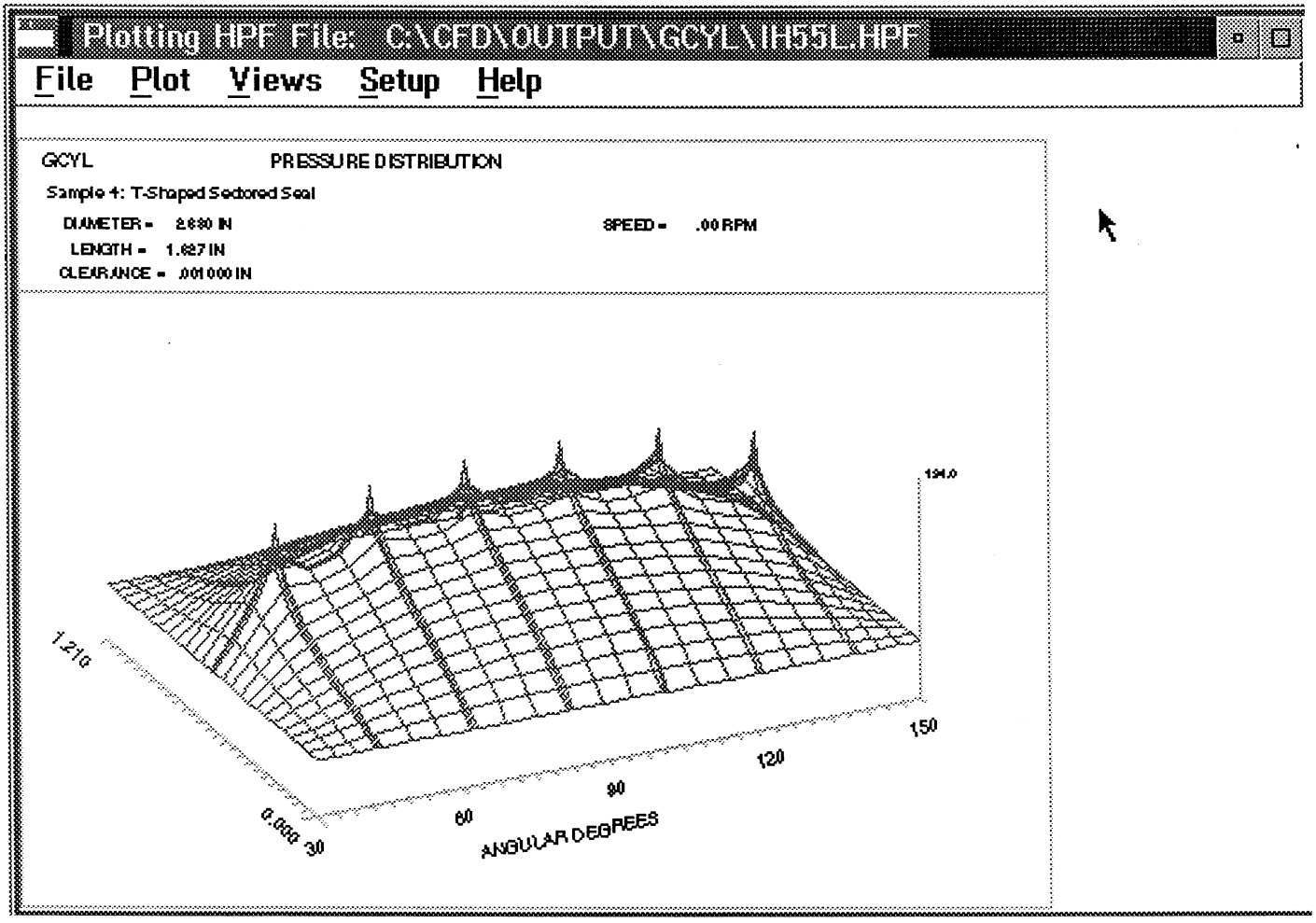


Figure 25: PLOT4DPM - Pressure Distribution Plot

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Bharat B. Aggarwal

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968 Albany Shaker Road
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12b. DISTRIBUTION CODE

13. ABSTRACT ***(Maximum 200 words)***

This manual for the OS/2 versions of the CFD Seal Analysis Industrial Codes describes the installation procedure, the system executive, and the procedures for using the graphical user interface to run the industrial codes. Please consult the technical manuals for the individual codes for technical details. The following components are included in the package: Executive Shell (EXEC); Gas Lubricated Spiral Groove Cylindrical and Face Seals (SPIRALG); Incompressible Spiral Groove Cylindrical and Face Seals (SPIRALI); Spiral Groove Face Seal Optimization Program (FACE); Gas Lubricated Cylindrical Seals (GCYL); Gas Lubricated Face Seals (GFACE); Incompressible Cylindrical Seals (ICYL); Incompressible Face Seals (IFACE); Labyrinth Seals (KTK); Seal Dynamics Analysis Code for Cylindrical and Face Seals (SEALDY); User Interface for Scientific Code (SCISEAL); Fluid Properties Calculation Program (FLUID); Plotting Program used by GCYL, GFACE, and ICYL (PLOT4DPM); and Plotting Program used by Dynamics code (XYPLOT).

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